

CLAIMS

I claim:

1. A method of forming silicon-carbide items, the method comprising:
 - (a) forming a preform from wood, then
 - (b) heating the preform under pressure to a first temperature in an autoclave, then
 - (c) heating the preform to a second temperature in a furnace at atmospheric pressure to pyrolyze the preform, the second temperature being higher than the first temperature; and then
 - (d) infusing the preform with a liquid containing silicon for forming a silicon-carbide item that retains the shape of the preform.
2. The method of claim 1, wherein:

in step (d), the liquid is a alloy.
3. The method of claim 1, wherein:

in step (d), after infusion, the preform is held for a selected time at a temperature between approximately 900°C and approximately 1450°.
4. The method of claim 1, further comprising:

after step (c) and before step (d), machining the preform to net-shape dimensions.

5. The method of claim 1, wherein:

step (a) comprises forming the preform from a solid block of wood.

6. The method of claim 1, wherein:

step (a) comprises forming the preform from wood particles and binders.

7. The method of claim 1, wherein:

the first temperature is between 375°C and 400°C.

8. The method of claim 1, wherein:

the second temperature is between 900°C and 1100°C.

9. The method of claim 1, wherein:

the first temperature is approximately 400°C; and

the second temperature is approximately 1000°C.

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10. The method of claim 1, wherein:

step (b) comprises increasing the temperature of the autoclave from a starting temperature to the first temperature at a maximum rate of 5°C per minute.

11. The method of claim 1, wherein:

step (c) comprises increasing the temperature of the furnace from a starting temperature to the second temperature at a maximum rate of 5°C per minute.

12. The method of claim 1, wherein:

step (b) comprises increasing the temperature of the autoclave from a starting temperature to the first temperature at a maximum rate of 5°C per minute; and

step (c) comprises increasing the temperature of the furnace from a starting temperature to the second temperature at a maximum rate of 5°C per minute.

13. The method of claim 1, wherein step (b) comprises:

covering the preform with a vacuum bag and evacuating air from the bag; then

heating the preform and vacuum bag to a drying temperature lower than the first temperature;
then

removing the vacuum bag and heating the preform to the first temperature.

14. A method of forming silicon-carbide items, the method comprising:
 - (a) forming a preform from wood, then
 - (b) covering the preform with a vacuum bag and evacuating air from the bag; then
 - (c) heating the preform and vacuum bag under pressure to a drying temperature in an autoclave; then
 - (d) removing the vacuum bag and heating the preform under pressure to a first temperature in the autoclave, the first temperature being higher than the drying temperature; then
 - (e) heating the preform to a second temperature in a furnace at atmospheric pressure to pyrolyze the preform, the second temperature being higher than the first temperature; and then
 - (f) infusing the preform with a liquid containing silicon for forming a silicon-carbide item that retains the shape of the preform.

15. The method of claim 14, wherein:

in step (f), the liquid is a alloy.

16. The method of claim 14, wherein:

in step (f), after infusion, the preform is held for a selected time at a temperature between approximately 900°C and approximately 1450°.

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17. The method of claim 14, further comprising:

after step (e) and before step (f), machining the preform to net-shape dimensions.
18. The method of claim 14, wherein:

step (a) comprises forming the preform from a solid block of wood.
19. The method of claim 14, wherein:

step (a) comprises forming the preform from wood particles and binders.
20. The method of claim 14, wherein:

the first temperature is between 375°C and 400°C.
21. The method of claim 14, wherein:

the second temperature is between 900°C and 1100°C.
22. The method of claim 14, wherein:

the first temperature is approximately 400°C; and

the second temperature is approximately 1000°C.

23. The method of claim 14, wherein:

step (d) comprises increasing the temperature of the autoclave from a starting temperature to the first temperature at a maximum rate of 5°C per minute.

24. The method of claim 14, wherein:

step (e) comprises increasing the temperature of the furnace from a starting temperature to the second temperature at a maximum rate of 5°C per minute.

25. The method of claim 14, wherein:

step (d) comprises increasing the temperature of the autoclave from a starting temperature to the first temperature at a maximum rate of 5°C per minute; and

step (e) comprises increasing the temperature of the furnace from a starting temperature to the second temperature at a maximum rate of 5°C per minute.

26. A method of forming composite components, the method comprising:

- (a) forming a preform from wood, the preform being shaped as a mold; then
- (b) pyrolyzing the preform; then

- (c) infusing the preform with liquid containing silicon; then
- (d) holding the infused preform at a selected temperature to form a silicon-carbide tool that retains the shape of the preform, the tool having at least one tooling surface for receiving layers of composite material; then
- (e) applying the layers of composite material to the tooling surface to form the component; then
- (f) curing the component on the tooling surface; and then
- (g) removing the cured component from the tool.

27. The method of claim 26, wherein:

in step (c), the liquid is a alloy.

28. The method of claim 26, wherein:

in step (d), the selected temperature is between approximately 900°C and approximately 1450°.

29. The method of claim 26, wherein step (b) comprises:

heating the preform under pressure to a first temperature in an autoclave, then

heating the preform to a second temperature in a furnace, the second temperature being higher than the first temperature.

30. The method of claim 26, wherein:

step (a) comprises forming the preform from a solid block of wood.

31. The method of claim 26, wherein:

step (a) comprises forming the preform from wood particles and binders.

32. The method of claim 26, further comprising:

after step (d) and before step (e), applying a mold release to the tooling surface.

33. The method of claim 26, wherein:

step (a) comprises forming the tool as a negative mold, the dimensions of the mold being undersized.

34. The method of claim 26, wherein:

step (a) comprises forming the tool as a positive mold, the dimensions of the mold being oversized.